

Dog Breed Classifier using Convolutional Neural Network

Domain Background:

Convolutional Neural Network(CNN) is used to analyze visual imagery. Dog Breed Classifier model can be designed using CNN. A model will be built where a number of real world images will be supplied and it will be able to identify a dog's breed. When a dog image will be given as input, it will be able to detect it's breed. In case, a human photo is given as input, it will detect the resembling dog breed. We will use Supervised Learning algorithm here for CNN. At the end, a web app will be built which will predict the breed of a user's input image.

Problem Statement:

The objective is to build a supervised machine learning model that will be able to identify a dog's breed when a user will input a real world image as input. The algorithms will be designed in below ways,

1. If a user input a dog's image, it will process that image and identify the dog's breed.
2. If a user input a human image, it will process that image and identify the resembling dog's breed.

Datasets and Inputs:

For this project, the input format will be of image type, as the goal is to input an image and identify the breed of the dog.

To design convolutional neural network, a large dataset is required. Here, the dataset is provided by Udacity. This dataset contains human and dog images.

Dataset of Dog Images: This dataset contains 8351 total images that is sorted into below ways,

Training Directory: *6,680 Images*

Testing Directory : *836 Images*

Valid Directory : *835 Images*

In each directory, there are 133 folders corresponding to dog breeds. The sizes of the images are different. The backgrounds also vary. Some images are cropped ones. The data is not balanced, as the number of images provided for each breed are not same.

Dataset of Human Images dataset: This dataset has 13233 total human images. The sorting is done as by names of human in 5750 folders. The size of each image is 250x250. The backgrounds are not same. Angles are also different. The data is not balanced, as the total image numbers in each image group are not same.

Solution Statement:

To develop the model supervised learning algorithm is used. Convolutional Neural Network(CNN) is used to process, analyze images and classify the breeds.

Convolutional Neural Network is a one of the deep learning methods, which is widely used to detect objects from images through visual imagery.

Here, the solution runs in three steps.

- 1) For detecting human images, existing algorithm like OpenCV's implementation of Haar feature based cascade classifiers are used.
- 2) For detecting dog-images, a pretrained VGG16 model is used.
- 3) Through the above steps when the image is detected as a human or a dog, the image is passed to an CNN. It will then process, analyze the image and make a prediction about the breed that matches the best out of 133 breeds.

Benchmark Model:

- 1) The CNN model that is created from scratch must have accuracy level of at least 10%.
- 2) The model created using transfer learning must have accuracy level of 60% and above.

Evaluation Metrics:

As it is a multi-class classification, Multi class log loss will be used for the evaluation of the prediction. As we mentioned, the datasets are not balanced, accuracy is not the correct indicator when it comes to performance. From Log loss, the uncertainty of prediction based on how much it varies from actual label can be determined. This will in turn help for the evaluation.

Project Design:

The steps are demonstrated below,

- 1) At first, the necessary dataset and libraries is to be imported. Then, it is required to pre-process the data and create train, test and validation dataset. After that, Image augmentation on training data will be performed.
- 2) Need to detect human faces using OpenCV's implementation of Haar feature based cascade classifiers.
- 3) Dog detector using pretrained VGG16 model is to be created.
- 4) A CNN is designed to process images and detect dog breeds from scratch through training, validating and testing the model.
- 5) A CNN is designed to Classify Dog Breeds using Transfer Learning with resnet101 architecture.
- 6) Below algorithm to combine Dog detector and human detector will be written,
 - a) When a dog is detected in the image, return the predicted breed.
 - b) When a human is detected in the image, return the resembling dog breed.
 - c) If neither is detected, provide output that indicates the error.

Review Link:

The proposal review link is shared below,

<https://review.udacity.com/#!/reviews/2588046>